

Listing of Claims

1. (currently amended) A method of detecting a loss of integrity in a blood circuit supplying blood to a patient, comprising the steps of: detecting a leak of blood from an extracorporeal blood circuit in at least two independent ways to generate at least two leak detection signals; deriving at least one composite signal responsive to said two leak detection signals; generating an alarm signal responsively to said at least one composite signal.

2. (currently amended) A method as in claim 1, wherein said ~~step of~~ deriving includes calculating a probability of a leak responsively to said at least two detection signals.

3. (currently amended) A method as in claim 1, wherein said ~~step of~~ deriving includes combining said at least two leak detection signals such that a sensitivity of detection of a leak is enhanced.

4. (currently amended) A method as in claim 3, wherein said ~~step of~~ calculating includes applying said leak detection signals to a network classifier.

5. (currently amended) A method as in claim 1, wherein said ~~step of~~ deriving includes applying a respective weight to said at least two leak detection signals and adding them.

6. (currently amended) A method as in claim 1, wherein said ~~step of~~ detecting includes sensing a presence of fluid outside said blood circuit and detecting a presence of air inside said blood circuit.

7-8. (canceled)

9. (currently amended) A leak detection device, comprising: a first detector outputting a first detection signal; a second detector outputting a second detection signal; a signal combiner connected to form a combination signal responsive to both said first and second detection signals to generate an alarm output for connection to an alarm device; said signal combiner being such that both a sensitivity and a reliability of leak detection represented by said combination signal is greater than said first and second detection signals alone or together; said first detector being adapted to detect a first condition that is correlated with a leak of blood from ~~in~~ a blood circuit; said second

detector being adapted to detect a second condition that is correlated with a leak of blood from ~~in~~ said blood circuit; said first and second conditions being associated with different physical phenomena.

10. (original) A detection device as in claim 9, wherein said combiner includes an analog summing circuit.

11. (original) A detection device as in claim 9, wherein said combiner includes a programmable processor.

12. (original) A detection device as in claim 9, wherein said first detector includes at least one of a detector of air in said blood circuit, a detector of fluid outside said blood circuit, a detector of pressure in said blood circuit, an image classifier connected to a camera oriented to image a patient, or a device to measure a patient heart rate, blood oxygen level, body weight, or the continuity or bioimpedance of tissue of the patient.

13. (currently amended) A leak detection device for detecting a leak in an extracorporeal blood treatment machine, comprising: a first detector outputting a first detection signal; a second detector outputting a second detection signal; a signal combiner connected to form a combination signal responsive to both said first and second detection signals to generate an alarm output for connection to an alarm device; said first detector being adapted to detect a first condition that is correlated with a probability of a leak in a blood circuit; said second detector being adapted to detect a second condition that is correlated with a probability of a leak in said blood circuit, wherein said first detector includes at least one of a detector of air in said blood circuit, a detector of fluid outside said blood circuit, a detector of pressure in said blood circuit, an image classifier connected to a camera oriented to image a patient, or a device to measure a patient heart rate, blood oxygen level, body weight, or the continuity or bioimpedance of tissue of the patient.

14-18. (canceled)

19. (currently amended) ~~A method as in claim 18;~~ A method of detecting an alarm condition in a medical treatment machine, comprising the steps of: combining detector signals from at least two indicators of an alarm condition such that a prediction of an alarm state is generated thereby and such that said prediction possesses at least one of a

higher reliability and a higher sensitivity than said detectors signals uncombined;
generating an alarm signal responsively to said prediction, wherein said different indicators include at least two of respective ones of a video image of a patient, a blood oxygen level of a patient, a body weight of a patient, a bioimpedance of a patient's tissue, a body temperature of a patient, a heart rate of a patient, a blood pressure of a patient, a breathing rate of a patient, a presence of fluid, and a presence of air in a fluid circuit.

20. (currently amended) A method as in claim 15 ~~19~~, wherein said ~~step of~~ combining includes deriving a probability of an alarm condition, said alarm signal indicating said probability.

21-24. (canceled)

25. (currently amended) A method of detecting a leak from a medical treatment machine, comprising: combining at least two ~~respective~~ different ones of detector signals ~~providing~~ providing: a video image of a patient, a blood oxygen level of a patient, a body weight of a patient, a bioimpedance of a patient's tissue, a body temperature of a patient, a heart rate of a patient, a blood pressure of a patient, a breathing rate of a patient, a presence of fluid, and a presence of air in a fluid circuit; said ~~step of~~ combining being effective to yield a prediction of a leakage of fluid from said medical treatment machine.

26. (currently amended) A method as in claim 25, wherein said ~~step of~~ combining includes deriving a probability of an alarm condition, said alarm signal indicating said probability.

27. (currently amended) A method as in claim 25, wherein said ~~step of~~ combining has the effect of amplifying a reliability of an estimate of said alarm condition indicated by said signal relative to any one of said detector signals alone by cumulating influence of multiple detector signals to generate a linear or non-linear combination.

28-31. (canceled)

32. (original) A method as in claim 25, wherein said medical treatment machine includes an extracorporeal blood circuit.

33. (original) A method as in claim 25, wherein said medical treatment machine includes a fluid circuit.

34-41 (canceled)

42. (original) A device for detecting a leak from a medical treatment machine, comprising: a signal filter connected to combine at least two respective ones of detector signals providing a video image of a patient, a blood oxygen level of a patient, a body weight of a patient, a bioimpedance of a patient's tissue, a body temperature of a patient, a heart rate of a patient, a blood pressure of a patient, a breathing rate of a patient, a presence of fluid,-and a presence of air in a fluid circuit; said signal filter being configured such that a prediction of a leakage of fluid from said medical treatment machine is generated by combining said at least two.

43. (original) A device as in claim 42, wherein said prediction includes a probability of an alarm condition, said alarm signal indicating said probability.

44. (original) A device as in claim 42, said signal filter combines said detector signals by cumulating influences of multiple detector signals to generate a linear or nonlinear combination thereof.

45. (original) A device as in claim 44, wherein said signal filter includes a network classifier.

46. (original) A device as in claim 42, wherein said signal filter includes a network classifier.

47. (original) A device as in claim 42, wherein said medical treatment machine includes a fluid circuit.

48. (original) A device as in claim 42, wherein said medical treatment machine includes an extracorporeal blood circuit.

49. (new) A method of detecting a loss of integrity in a blood circuit supplying blood to a patient, comprising the steps of: detecting a leak in at least two independent ways to generate at least two leak detection signals; deriving at least one composite signal responsive to said two leak detection signals; generating an alarm signal responsively to said at least one composite signal, wherein said ~~step of~~ deriving includes calculating a probability of a leak responsively to said at least two detection signals.

50. (new) A method of detecting a loss of integrity in a blood circuit supplying blood to a patient, comprising the steps of: detecting a leak in at least two independent ways to generate at least two leak detection signals; deriving at least one composite signal

responsive to said two leak detection signals; generating an alarm signal responsively to said at least one composite signal, wherein said deriving includes applying a respective weight to said at least two leak detection signals and adding them.

51. (new) A method of detecting a loss of integrity in a blood circuit supplying blood to a patient, comprising:

detecting first and second signals from first and second sensors, respectively, the sensors detecting respective physical parameters associated with the blood circuit; and

combining first and second signals with respective weights to create an alarm signal, the combining being such that the weighted value of the first signal required to generate the alarm varies depending on the weighted value of the second signal.

52. (new) A method of detecting an alarm condition in a medical treatment machine, comprising the steps of: combining detector signals from at least two indicators of an alarm condition such that a prediction of an alarm state is generated thereby, wherein said combining includes cumulating the influence of multiple detector signals to generate a linear combination.

53. (new) The method of claim 22, wherein the at least two indicators are signals indicative of a leak of blood from a blood circuit.

54. (new) A device for detecting an alarm condition in a medical treatment machine, comprising: a signal filter adapted to combine detector signals from at least two signals indicating an alarm condition to generate a weighted sum of the at least two signals and indicating an alarm condition responsively to the weighted sum the weighted sum has a more reliable indicator of the alarm condition than either of said detectors signals alone; said signal filter being further adapted to generate an alarm signal responsive to said prediction.

55. (new) A device as in claim 54, wherein said medical treatment machine is a blood processing machine and said alarm condition is a leak of fluid therefrom.

56. (new) A device as in claim 55, wherein said alarm condition is a leakage of blood from a blood circuit of said blood processing machine.

57. (new) A device as in claim 54, wherein said at least two different indicators of a status of a patient, medical treatment machine, or environment thereof.

58. (new) A device as in claim 57, wherein said different indicators include at least two of respective ones of a video image of a patient, a blood oxygen level of a patient, a body weight of a patient, a bioimpedance of a patient's tissue, a body temperature of a patient, a heart rate of a patient, a blood pressure of a patient, a breathing rate of a patient, a presence of fluid, and a presence of air in a fluid circuit.

59. (new) A device as in claim 54, wherein said prediction includes a probability of an alarm condition, said alarm signal indicating said probability.

60. (new) A device as in claim 54, wherein said signal filter combines said detector signals by cumulating influences of multiple detector signals to generate a linear or non-linear combination thereof.

61. (new) A device as in claim 54, wherein said signal filter includes a network classifier.